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DEPARTMENT OF AGRICULTURE.

ADMINISTRATION REPORT OF THE DIRECTOR FOR 1916.

I HAVE the honour to forward a report on Agriculture in Ceylon in 1916 and on the work of the Department of Agriculture.

SECTION I.

AGRICULTURE IN CEYLON.

Tea.

2. The area under tea is now estimated to be approximately 400,000 acres, and the exports for the year were black tea 198,388,085 lb. and green tea 4,094,874 lb., against 206,464,720 lb. and 5,165,057 lb. respectively during 1915. This decrease of slightly over 9 million lb. of tea was brought about by the severe drought experienced during the early months of the year, preceded by the partial failure of the north-east monsoon in 1915. The average price realized at local auctions was 51·79 cents per lb., against 56·79 cents in 1915 and 46·35 cents in 1914.

3. The removal of tea under rubber in the low-country continues, but some areas are being opened up on patana lands up-country. Young tea in the low-country suffered severely at the beginning of the year during the drought, and a certain number of bushes died out.

4. Modifications in manuring had to be continued owing to the stoppage of potash salts. Recourse has been had to the increased use of lime and nitrate of soda and to additional cultivation. These treatments are designed to utilize the reserve potash in the soil, and it is at present held that so far the lack of potash in manurial mixtures has not been severely felt.

5. The shot-hole borer continues to cause a considerable amount of anxiety in certain districts, and is under investigation. This pest is widespread, and 539 estates are now declared as being infected. The investigations into the pest and into various methods for control are being continued, and are dealt with more fully later in the report.

6. Tea tortrix causes damage in some districts, and the spread of this pest is being inquired into and methods of control investigated.

7. A new fungus disease caused by a species of *Hypochnus* was under investigation upon two estates. It is probably the same fungus that caused some damage to coffee in the years of leaf-disease, and it has been satisfactorily brought under control on those estates on which it occurred.

Rubber.

8. The dry months of January and February caused an early wintering of rubber trees. The crop came in satisfactorily in March and April, but the heavy rains which fell from May to August interrupted tapping and caused shortage of crop on some estates.

9. The total exports of Ceylon rubber was 54,698,729 lb., against 46,566,187 lb. in 1915. This shows an increase of output of 17·5 per cent. The average price at local auctions was Re. 1·79, against Re. 1·65 the previous year. First quality crêpe commanded a slightly higher price than smoked sheet during the first half of the year, but during the second half these grades fetched equal prices.

10. Cultivation has been maintained during the year. Deep forking and liming has been commonly practised, while contour drains have received considerable attention. In some districts stone walls have been erected across hill slopes to prevent wash.

11. Some estates have obtained average yields of 650 lb. of rubber per acre and upwards, but the generality of estates average about 400 lb. per acre.

12. Tapping methods vary, but single cuts on half or one-third of the circumference of the tree are generally favoured, although double cuts are still continued in several districts.

13. Thinning operations are now general, and all new plantations are being planted at distances varying from 20 to 25 feet apart. This will probably induce conditions less favourable to the development of fungus diseases.

14. Diseases have during the year received a considerable amount of attention, and the lectures given by the Botanist and Mycologist before various Planters' Associations have been greatly appreciated. Canker infections were treated on all estates during the dry months of January and February, but this disease became noticeable in some localities in the wet months of May to August. A serious outbreak of pod disease and leaf-fall occurred during the year, but attempts were made by estate authorities to bring the disease under control. Bark rot, root, and other diseases are becoming well known to all rubber planters, and they are fully alive to the importance of having them properly treated.

Coconuts.

15. There are now over 1,000,000 acres under coconuts in the Colony. Considerable plantations have been made during the past few years, and careful cultivation and manuring is, in the majority of cases, being given to these new areas. In the year under review only a small area of new land was planted out, the greater portion being on old cinnamon lands. Large crops were obtained in most districts as the result of the favourable rains of the preceding year.

16. There is an extension of improved cultivation of coconuts, and a large number of estates testify to the beneficial results obtained by systematic ploughing and disc harrowing.

17. Prices for coconut products varied greatly during the year. During the first quarter copra prices ranged from Rs. 89·50 per candy (560 lb.) to Rs. 70·50; coconut oil from Rs. 625 to Rs. 565 per ton; desiccated nut from 20 to 18 cents per pound; bristle fibre stood at Rs. 9·25 per cwt.

During the second quarter copra fell to Rs. 65·75; coconut oil in sympathy fell to Rs. 560; desiccated nut also fell to 17½ cents; and bristle fibre stood at the same price as during the previous quarter.

In the third quarter copra prices remained low, and did not go above Rs. 57; oil did not fetch more than Rs. 470; desiccated nut fell to a cent less than last quarter; bristle fibre ranged between Rs. 9·25 and Rs. 8·50.

The fluctuations in the prices of copra during the last quarter of the year were so slight as to make them almost constant till the collapse of the market during the last days of the year as the result of difficulties with exchange. At the end of the quarter the price stood at only Rs. 55 per candy; oil, however, rose in price during this period, and by the end of the quarter had risen to Rs. 555 per ton; desiccated nut also rose to 17 cents; and bristle fibre dropped to Rs. 7.

18. The exports of coconut products declined considerably during the year owing to the high rate of freight and shortage of tonnage. The exports for 1916 as compared with 1915 are shown in the following table:—

		1916.		1915.
Coconuts	No.	4,079,608	...	5,503,716
Copra	Cwt.	1,284,673	...	1,102,674
Coconut oil	,,	322,316	...	488,484
Desiccated coconuts	,,	306,325	...	342,150
Coconut poonac	,,	79,676	...	194,147

Cacao.

19. The spring crop was short, but weather conditions were favourable for this crop after May, with the result that the autumn crop was a heavy one.

20. The cultivation of this crop receives careful attention on some estates, but on small peasant holdings little or no cultivation is practised. Diseases were not very prevalent during the year, and diseased pods were less in number than usual.

21. The exports amounted to 69,998 cwt., as against 78,458 cwt. in 1915, and prices were satisfactory, except during the last two months of the year.

Cardamoms.

22. The weather conditions for this crop were favourable, and normal yields were obtained. The exports, however, were only 427,843 lb. against 519,039 lb. in 1915. Prices were low throughout the year, and it is estimated that there are considerable stocks being held in the Colony.

Cinnamon.

23. The cinnamon industry suffered severely during the year owing to low prices and a practical stoppage of the demand for the finer qualities. The exports amounted to 19,859 cwt, of quills and 24,899 cwt. of chips, against 38,767 cwt. of quills and 18,840 cwt. of chips in 1915.

24. Cinnamon continues to be replaced by coconuts over fairly large areas, and in the Negombo area alone it is estimated that over 500 acres of cinnamon lands were planted in coconuts during the year.

Subsidiary Products.

25. The following were the exports of minor agricultural products during the year:—

	Cwt.
Citronella	12,196
Arecanuts	123,205
Kapok	4,416
Papain	313
Cinchona bark	82

There is an increasing demand for kapok and for papain. The latter product is one that can readily be prepared by small cultivators, and it is hoped that the extension of the industry will continue.

26. The Ceylon Sugar Refineries Company turned out their first sugar during the year from the factory erected at Valuvedditturai, Northern Province. A distillery has also been erected, and trial runs were being made at the close of the year.

Native Products.

27. In native products conditions were normal during the year. The paddy in some districts suffered severely by the drought in the early part of the year, but mid-year crops were satisfactory. Efforts were made to encourage a greater amount of attention to growing curry stuffs, of which the Colony produces only a very small proportion of its requirements.

SECTION II.

WORK OF THE DEPARTMENT OF AGRICULTURE.

28. The mycological and botanical officers of the Department were fully occupied during the year, and details of their work are given in Annexure I. The heavy rains in the middle of the year resulted in fungus diseases being very prevalent, and considerable time was given to the examination of specimens in the laboratory, to visits to estates, and to lectures to Planters' Associations. The Assistant Botanist and Mycologist completed investigations into the formation of nodules in the cortex of *Hevea brasiliensis*, and was engaged with the Rubber Research Chemist on an investigation into the occurrence of latex vessels in the same tree.

29. The water hyacinth was found near Kandy, Kadugannawa, and Chilaw during the year, and has been dealt with.

30. Annexure II. gives the details of the work of the Entomological Division. Tea tortrix has been severe in some districts during the year. Investigations into the shot-hole borer of tea have been continued, and control schemes have been worked out for trial upon several estates. The control of this pest is not a simple matter, as so many factors are involved, but it is hoped that, with co-operation of all tea estates affected with the pest, a gradual reduction of its numbers may be brought about, and the ultimate reduction of the tea crops averted. The presence of *Icerya purchasi* in the Colony has been recorded for the first time. This is a serious pest of various plants, and prompt efforts will have to be made to keep it under control.

31. The Chemical Division, as detailed in Annexure III., has made investigations into the production of potash from jungle in the North-Central Province. There appears to be little doubt in the minds of most planters in the Colony that the shortage of potash, through the shutting out of all German supplies, will be eventually felt by the agricultural industries. At present efforts are being made to liberate supplies locked up in the soil by cultural and other methods, but the question that may have to be answered is whether the Colony cannot produce a supply of potash sufficient to meet its most urgent requirements. There are large areas of low scrubby jungle in the North-Central Province of the Colony of little or no value, and it may be possible that agriculturists will have to consider the desirability of applying for areas of this jungle to be burned for the production of potash. Agriculturists in England have had to resort to hedge trimmings and other refuse vegetable matter for the production of potash for their most urgent needs, and the valueless jungle in the Colony affords an asset for the agricultural industries should the war be prolonged and normal supplies of potash unprocurable.

32. The Rubber Research Chemist has completed several investigations with the effects of various methods of preparing raw rubber, and these have produced definite conclusions that are of value and importance for the industry. The researches are being continued, and a further series of samples is being prepared for vulcanization at the Imperial Institute.

33. Annexure IV. deals with the work of the Division of Low-country Products and School Gardens. This work relates mainly to the school gardens, of which there are now 327. Of the total number of school gardens, 160 were awarded grants of varying value during the year for satisfactory work, and there is evidence that in some localities these gardens are affording opportunities to the young to become acquainted with the teachings of nature and with the methods of dealing with plants of economic value. Many of these school gardens are well kept, but it would appear to be most desirable that greater attention be given in them to the food stuffs used by the village population.

34. The work of the Botanic Gardens is summarised in Annexure V. Considerable planting and improvement has been made at Peradeniya, and progress in labelling has been continued. At Hakgala some improvements have been carried out, and certain trials made with various economic plants. The Nuwara Eliya Gardens have been maintained in satisfactory order. Tapping experiments on the rubber trees at Henaratgoda have been continued, and nursery stocks of Ipecacuanha plants, for which there has been a good demand, have been maintained. The gardens attached to His Excellency the Governor's residences and to the residences of the Colonial Secretary have been maintained in satisfactory order

during the year, and a considerable amount of time has been given to laying out the Government bungalow gardens at Colombo. Advice has also been given by officers of this division of the Department on tree planting at Mannar, Talaimannar and Kandy.

35. The details of the work carried out at Experiment Stations is shown in Annexure VI. Manurial experiments with tea, rubber, and cacao were continued at Peradeniya, experiments in tapping rubber at Peradeniya and Henaratgoda Gardens, coconut experiments at Maha Iluppalama and Chilaw, and paddy variety experiments at Peradeniya. The trials of Sudan Dura at Anuradhapura were encouraging, and there are signs that this recently introduced grain is likely to be appreciated by the villagers.

36. Annexure VII. contains the work of the tobacco planter. The trials are being continued at Jaffna, but the reports from the Imperial Institute on samples of the 1915 crop came too late to enable a modification in the 1916 methods of curing. This report shows that the heavier types of pipe tobacco are preferred in the English market, and that some of the types of tobacco from Jaffna showed an excess of chlorine. Irrigation by split bamboo troughs proved unsatisfactory in 1916, and the resulting crop was a small one. Changes have been made to ensure satisfactory irrigation, and experiments are being made to determine, if possible, the source of the excess of chlorine in the Jaffna grown tobacco,

37. Annexure VIII. gives details of the working of Co-operative Credit Societies. The number of members has increased from 4,258 to 6,488 during the year, but the movement does not increase as rapidly as was expected, and the working of several societies at present leaves much to be desired.

38. The work of the School of Agriculture is given in Annexure IX. Seventy-one students were admitted to the English class, but 7 withdrew, and 6 vernacular trained teachers received a two-term course of instruction. For the final examination 56 students presented themselves. Of these 15 failed to qualify. Interest in the school is being taken by the permanent planting community, and 6 gold medals and 4 silver medals have been offered for competition during the 1916 course.

RUBBER EXPERIMENTS.

39. The results of the manurial experiments with rubber have been continued, and the yields obtained are being carefully recorded. The following brief summary of the results up to the present has been prepared by the Agricultural Chemist :—

The effect of the general *organic* mixture, although slow at first, has shown a steady improvement in yield, though not sufficiently above the normal increase of the control plot to pay for the expenditure.

Excess of nitrogen applied annually gave a large increase in 1915, which was not maintained in 1916, the increase being less than the control plot.

Excess of phosphoric acid also gave a large increase in 1915, which was fairly maintained in 1916, the yield per tree for 1916 being 4¼ lb. the highest of all the plots.

Excess of potash results have been unsatisfactory, but in 1916 the increase was nearly double that of the control plot, although the yield per tree is still markedly less.

The effect of a complete *mineral* mixture was better than the *organic* mixture in 1915, but only shows half the increase in 1916, although the mixtures contain the same amount of nitrogen, potash, and phosphoric acid.

It is to be noted that the unmanured (control plot) still shows the greatest increase in girth, viz., 4·41 inches per annum, followed by the mineral and organic mixture plots. The potash plot shows the least average increase, viz., 3·95 inches per annum, the increase for 1916 being only 2·95 inches.

The manured plots as a whole showed healthier and stronger foliage, and the wintering period generally was two weeks later than unmanured plots. A few trees in these plots suffered from bark rot, but none from die-back or pod disease.

40. The tapping experiments at Peradeniya and Henaratgoda have been continued. A new experiment was begun at Henaratgoda to determine the yield from two cuts on one quarter as compared with the yield from one cut, both quarters being on the same tree. At Peradeniya experiments have been begun to determine the yield from renewed bark of different ages, and also to ascertain whether any relation holds between the yield and the botanical characters of different varieties of Hevea.

COCONUT EXPERIMENTS ON ESTATES.

41. These experiments are being carried out in conjunction with Mudaliyar A. E. Rajapakse on estates at Negombo and Puttalam, and in co-operation with the North-Western Rubber Co., at Pitiakande. Accurate data relative to the rate of growth under different cultural and manurial treatments are being kept, but they have not yet been carried on for a sufficient length of time to draw even general deductions therefrom.

EXPENDITURE.

42. The following is a statement of expenditure for the financial year 1915-16 :—

	Rs.	c.
Salaries	122,500	48
Travelling	10,108	36
Labour and upkeep, Peradeniya Gardens ...	15,006	15
Labour and upkeep, Hakgala Gardens	4,639	25
Labour and upkeep, Henaratgoda Gardens ...	2,106	51
Labour and upkeep, Nuwara Eliya Gardens ...	1,532	00
Labour and upkeep, Experiment Station, Peradeniya	22,407	60
Labour and upkeep, Experiment Station, Maha Iluppalama	5,507	81
Labour and upkeep, Experiment Station, Anuradhapura	9,005	96
Coconut Trial Ground, Chilaw	1,848	28
Labour and upkeep, School Gardens	4,695	9
Upkeep of Library, Laboratory, Herbarium, and Museum	497	20
Incidental expenses ...	642	12
Stationery	735	85
Printed forms	142	22
Binding allowance ...	70	0
Agricultural Education :—		
Salaries	8,176	63
Lecturing fees	1,514	13
Travelling	741	72
Incidental expenses ...	892	3
Catering for six students ...	315	0
Rent of quarters ...	1,050	0
Furniture	1,893	12
Stationery	969	66
Co-operative Credit Societies :—		
Salaries	3,354	0
Travelling	1,061	37
Incidental expenses ...	4	50
Stationery	101	58
Rubber Research :—		
Salaries	7,858	47
Travelling	1,565	60
Conduct of investigation in London	7,794	39
Incidental expenses ...	301	97
Special Expenditure :—		
Experimental cultivation of tobacco	7,629	35
General laboratory expenditure for Mr. Speyer, Entomologist	378	7
Total ...	246,947	46

This expenditure may be itemized under the following sub-heads :—

	Rs.	c.
Administration	22,411	25
Scientific Investigations, including Special Expenditure on Rubber Research and Shot-hole Borer Investigations	53,972	56
Experiment Stations, including Special Expenditure on Tobacco Investigations ...	72,742	75
Botanic Gardens	52,537	57
Education (School of Tropical Agriculture and School Gardens)	40,761	88
Co-operative Credit Societies ...	4,521	45
	246,947	46

RECEIPTS.

43. The following receipts were collected during the year :—

	Rs.	c.
Head Office (Publications, &c.) ...	308	0
Royal Botanic Gardens, Peradeniya ...	2,656	3
Hakgala Gardens	617	54
Henaratgoda Gardens	1,209	91
Nuwara Eliya Gardens	43	0
Experiment Station, Peradeniya ...	20,982	55
Experiment Station, Maha Iluppalama ...	1,200	42
Tobacco Trial Ground, Jaffna ...	588	50
School of Tropical Agriculture ..	4,072	11
Contributions, Rubber Research Scheme ...	8,000	0
Total ...	39,678	6

To this must be added the value of seeds and plants given gratis to Government institutions from the following :—

		Rs.	c.
Peradeniya Gardens	... ..	2,302	25
Hakgala Gardens	... ...	490	0
Henaratgoda Gardens	... ..	24	0
Experiment Station, Peradeniya	... ...	21	60
	Total	2,837	85

PUBLICATIONS.

44. The following publications were issued during the year :—

Annals of the Royal Botanic Gardens, Peradeniya, Vol. VI., Part II., November, 1916.

Bulletins of the Department of Agriculture :—

No. 23.—Vulcanization Tests. Two Interim Reports from the Imperial Institute on Samples of Rubber prepared by L. E. Campbell. January, 1916.

No. 24.—Vulcanization Tests. Summary of Third Interim Report from the Imperial Institute on Samples of Rubber prepared by L. E Campbell. September, 1916.

No. 25.—Hevea Tapping Results, Experiment Station, Peradeniya, 1915. T. Petch. August 1916.

No. 26.—Cacao, Experiments in Manuring. M. Kelway Bamber and D. S. Corlett. September, 1916.

No. 27—Vulcanization Tests. Fourth Interim Report from the Imperial Institute on Samples of Rubber prepared by L. E. Campbell. September, 1916.

No. 28.—On the Formation of Nodules in the Cortex of *Hevea brasiliensis*. G. Bryce. October, 1916.

No. 29—Diseases of *Hevea brasiliensis*. G. Bryce. December, 1916.

Leaflet on Shot-hole Borer, by E. R. Speyer.

Leaflet on Advantages of Co-operative Credit Societies, by N. Wickremeratne.

LEGISLATION

45. The following regulations relating to the work of the Department were passed during the year under the Insect Pest and Quarantine Ordinance, No. 5 of 1901 :—

Eradication of Castor Oil Plant.

Shot-hole Borer.

Plant Pest Committees.

Importation of Tea Seed into Ceylon.

STAFF CHANGES.

46. The following staff changes were made during the year :—

(1) Mr. R. N. Lyne resigned his appointment as Director of Agriculture, with effect from September 4. Mr. T. Petch, Botanist and Mycologist, acted from September 4 to November 30.

(2) Mr. F. A. Stockdale, Director of Agriculture, Mauritius, was appointed Director of Agriculture, Ceylon, with effect from December 1, the date of his arrival in the Colony.

(3) Mr. T. Petch, Botanist and Mycologist, returned from leave and resumed duties on April, 25.

(4) Mr. M. Kelway Bamber was away in Sumatra from March 2 to April 5.

(5) Mr. H. F. Macmillan, Superintendent of Botanic Gardens, was absent on leave, with effect from May 21.

(6) Mr. D. S. Corlett resigned his appointment as Manager, Experiment Station, Peradeniya, with effect from September 3, and Mr. H. A. Deutrom acted until the end of the year.

(7) The following appointments were made in the clerical and garden staffs of the Department:—

Mr. W. K. B. D. Perera, Librarian, with effect from July 1, *vice* Mr. R. Udalagama, transferred.

Mr. T. Chellappah, Clerk, Head Office, with effect from July 24, *vice* Mr. S. J. Jayasena, transferred.

Mr. W. G. Perera, Assistant Foreman, Experiment Station, Peradeniya, with effect from January 1, *vice* Mr. W. H. Weerasekera, resigned.

Mr. C. P. Crispyn, Rubber Tapping Conductor, Experiment Station, Peradeniya, with effect from January 16, *vice* Sangaran, resigned.

Mr. J. R. Alles, First Upper Gardener, with effect from February 1, *vice* Mr. W. P. Jasingha, resigned.

Mr. L. A. A. Perera, Assistant Foreman, Experiment Station, Peradeniya, with effect from April 1, *vice* Mr. P. G. Saminathan, transferred.

Mr. P. G. Saminathan, Foreman, Dry Zone Station, with effect from April 1.

Mr. K. J. Sylva, Foreman, Peradeniya Gardens, transferred for work in connection with the Government Bungalow Gardens, with effect from June 1.

Mr. P. A. Perera, Rubber Tapping Conductor, Experiment Station, Peradeniya, with effect from October 1, *vice* Mr. C. P. Crispyn, transferred.

Mr. C. P. Crispyn, Assistant Foreman, Government Stock Gardens, with effect from October 1, *vice* Mr. M. E. Perera, resigned.

W. Mudiyanse, Gardener, Queen's House, Colombo, with effect from December 15, *vice* R. M. K. Ratnayake, resigned.

F. A. STOCKDALE,
Director of Agriculture, and Registrar,
Co-operative Credit Societies.

March 10, 1917.

ANNEXURES.

I.—SUMMARY REPORT ON THE WORK OF THE BOTANICAL AND MYCOLOGICAL DIVISION.

MYCOLOGY.

Consignments of diseased plants for examination and report numbered 240, of which 116 were *Hevea brasiliensis* and 57 tea, the remainder including coconut, citrus, coffee, cacao, paddy, plantain, cupressus, ceara, cucumber, betel, brinjal, bandakkai, grape, guava, pomegranate, pea, grevillea, and various green manure plants.

Visits have been made to practically all the low-country districts during the year. Lectures on Hevea diseases were given at Taldua, Tebuwana, Kegalla, Colombo, Matale, and Kurunegala.

HEVEA.

The outstanding feature of the year was the prevalence of pod disease and the consequent leaf-fall, two diseases which, as stated in 1912, are caused by the same fungus. This was no doubt due to the continuance of the rains of the south-west monsoon through August and September. As it has been shown that the fungus produces resting spores in the diseased pods and remains dormant in branches partly killed back, it is imperative that dead branches and dead hanging fruits should be pruned off during the dry weather.

Ustulina zonata Lev., which has been known for some time to cause root disease in Hevea, has been found to occur commonly on old canker wounds, acting as a wound parasite. As the mycelium penetrates into the heart wood, it is scarcely possible to save a tree by cutting out the diseased tissue if the fungus has got a good hold. *Ustulina zonata* has been found to develop on Hevea logs left lying in the plantation after thinning out, a fact which emphasizes the necessity of clearing out all felled Hevea. Another fungus of the same class, *Kretzschmaria micropus* (according to our herbarium specimens determined by Berkeley), has also been found to act as a wound parasite in the case of old canker wounds; this also occurs on Hevea logs. Cleaning up, *i. e.*, removing dead scales of bark from canker wounds, and tarring them where the wood is exposed, would prevent loss from this cause.

Abandoned tea under rubber has given serious trouble in some districts by serving as a starting point for *Fomes semitostus* (*lignosus*), or by affording material along which this fungus can travel from one rubber tree to the next. Hevea stumps left after thinning out have proved centres for *Ustulina zonata*, *Fomes semitostus*, and *Poria hypobrunnea;* while cacao stumps have served similarly for *Ustulina zonata*, *Fomes semitostus*, and brown root disease. It is essential for the health of the plantation that tea, cacao, and Hevea stumps shall not be left.

Some uneasiness was felt during the year by the announcement of a new root disease caused by a species of Poria. This has been known to occur in Ceylon since 1905, when it was attributed to *Poria vincta*, on the evidence of the herbarium specimens identified by Berkeley. It has occurred during the last two years on Hevea and *Tephrosia candida* in a new clearing on the Experiment Station, Gangaruwa, where it originated on jungle stumps, and has been found on Hevea stumps in the neighbourhood of Peradeniya. The Ceylon species has been named *Poria hypobrunnea*. Its mycelium forms, on the affected roots, red strands which ultimately turn black, thus resembling the mycelium of *Poria hypolateritia*, but, as far as is known at present, the latter species only attacks tea.

An investigation was begun into the cause of the large wounds found on exposed Hevea roots, hitherto regarded as the result of bruises from stones or from coolies walking over them.

Among the miscellaneous fungi recorded on Hevea during the year are *Ascochyta Hevea* n. sp. and *Sphaerella Heveæ* n. sp., on Hevea leaves; and *Venturia emergens* n. sp., *Fracchiva brevibarbata* (B & Br.) Petch, *Phlyctaena Heveae* n. sp., *Fracchiaea brevibarbata* (B. & Br.) Petch, *Phlyctaena Hevea* n. sp., *Fracchiæa depressaa* n. sp., *Haplosporella crypta* n. sp., on Hevea branches.

TEA.

A new and serious tea disease has made its appearance in two districts in the low-country. It is caused by a species of *Hypochnus*, and is therefore similar to the "black rot" of coffee in South India, though the actual fungus differs in details from the Indian species. It is probable that it is identical with the "threads" with occurred, together with *Hemileia vastatrix*, on coffee in Ceylon in the days of the coffee leaf disease, about which so much discussion centred on the question whether they were part of the *Hemileia* or not. The fungus occurs on the exterior of the branches and twigs, and travels to the leaves *via* the leafstalks. It causes most damage when it reaches the younger leaves, which become at first mottled brown and finally black. The dead leaves do not fall off, but remain hanging to the twigs attached by a thin strand of mycelium. It has been determined that the fungus is still alive on prunings two months after pruning. The disease is being combated by burning the prunings from infested bushes and spraying with Bordeaux mixture after pruning

An up-country stem disease of tea is under investigation. It is characterized by the appearance, after pruning, of a delicate white film of mycelium on the pruning cut. When the affected branches are split, the wood is found to be diseased, usually down the centre, though the branch gives no outward indication of disease. *Nectria diversispora* has been obtained from the diseased tissue. The ultimate effort on the bush is not known.

MISCELLANEOUS.

Among the miscellaneous fungi recorded during the year are *Oidium* sp., on brinjal; *Erysiphe Polygoni* DC. on *Pisum sativum* L.; *Colletotrichum orchidaccarum* Allesch., and *Fusarium* sp., on cultivated orchids; *Glocosporium Musarum* Cke. & Mass., *Scolecotrichum Musae* Zimm., *Brachysporium torulosum* Syd., *Macrophoma Musæ* (Cke.) Berl. and Vogl., and *Glomerella* sp., on plantains; *Melanconium* sp., on pomegranate; *Colletotrichum* sp., on Crotalaria; *Tubercularia* sp., on Rosselle, &c.

HERBARIUM.

When on leave in England the Botanist and Mycologist was occupied in examining the Ceylon specimens in the Kew Herbarium for about two months. As a result the Ceylon Polypori and Lentini have been determined, and lists of these published. Considerable progress has also been made in the determination of other groups. Four hundred specimens have been added to the mycological herbarium during the year.

FUMIGATORIUM.

During 1916 2,587 cases of tea seed, 331 cases of citrus fruits, and 426 miscellaneous packages of plants have been treated at the fumigatorium. Plans for improvement of the fumigatorium were under consideration during the year.

BOTANY.

292 specimens of flowering plants were sent in for determination.

WEEDS.

The water hyacinth was found in a locality near Kandy in May. All the plants were removed and destroyed. In December it reappeared in the same spot. It has been determined that the plant seeds freely in Ceylon, and experiments have demonstrated that the seeds do not germinate immediately, but remain dormant for a long time. In any locality where it has flowered, it may therefore be expected to recur at fairly long intervals. It was found at Kadugannawa, also in May, and in the Chilaw District in June. Paintings of the plant were sent for exhibition in the infested districts.

Two new weeds, *Acanthospermum humile* DC. and *Mitracarpus villosus* Cham. & Schlect., were recorded during the year. The second has been reported as a troublesome weed on coconut estates in the North-Western Province, where it is known as the "eleven-day weed."

PUBLICATIONS.

The following articles have been published during the year in the Annals of the Royal Botanic Gardens, Peradeniya:—

The Girth Increment of *Hevea brasiliensis*.

A Preliminary List of Ceylon Polypori.

Ceylon Lentini.

Revisions of Ceylon Fungi, part IV.

Notes on Water Hyacinth, *Stachys arvensis*, *Mimosa pudica*, *Agrimonia zeylanica*, *Cuscuta chinensis*, new weeds, Nagadarana.

T. PETCH,
Botanist and Mycologist.

January 30, 1917.

II.—SUMMARY REPORT ON THE WORK OF THE ENTOMOLOGICAL DIVISION.

GENERAL ENTOMOLOGY.

An entire revision of the arrangement of the specimens and notes collected by previous Entomologists has been commenced with a view to placing the material on an economic, as opposed to a systematic, basis.

INSECT PESTS

The following pests have been under investigation during the year :—

Tea.

Tea Tortrix (*Homona coffearia*) has been very severe throughout the year in Maskeliya, Central Province ; outbreaks have also been reported in January at Dehiowita, Province of Sabaragamuwa ; in June at Demodara, Uva ; in November at Ratnapura, Province of Sabaragamuwa ; and Talawakele, Central Province.

The Small Tussock Moth (*Orgyria postica*) has been reported in the caterpillar stage in January at Talawakele, Central Province ; in October at Kandy, Central Province.

The Fringed Nettle Grub in May and July at Dehiowita, Province of Sabaragamuwa.

The Red Borer (*Zeuzera coffeæ*) in January at Pelmadulla, Province of Sabaragamuwa ; in May at Bentota, Southern Province ; in June at Balangoda, Province of Sabaragamuwa ; in July at Haputale, Province of Uva ; in August at Ingiriya, Western Province ; in October at Kuruwita, Province of Sabaragamuwa ; in November at Badulla and Bandarawela, Province of Uva. In the Badulla District of the Province of Uva the caterpillars have been heavily parasitized by Braconids, which were hatched from their cocoons in November.

Bagworms (*Psychidæ*) have been reported in October from Ingiriya.

Shot-hole Borer (*Xyleborus fornicatus*) has shown the usual tendency to increase its distribution ; but, with the exception of Upper Hewaheta, Central Province, no actually new districts have been invaded. In the Kandy District there has been a marked decrease on certain estates, due to climatic conditions. In Uva, on the other hand, it has increased locally. It is under special investigation. A number of estates have been added to the register, but it has been found necessary to remove others after further investigation. In future it has been decided that no estates will be registered before specimens of infected bushes have been examined by the Entomological Division, and estates submitting reports of infestation are asked to send in specimens at the time of report.

Xyleboridæ.—Two species, distinct from *X. fornicatus*, have been recorded in tea in the Balangoda (Province of Sabaragamuwa) and Badulla Districts (Province of Uva), the former affecting dead twigs only. Both are very minute, being markedly smaller than true shot-hole borer. Another small species, probably *Xyleborus coffeæ*, was collected in nurseries at Kamburupitiya, Matara (Southern Province).

Tea Weevil (*Astycus* sp.) was reported from Uda Pussellawa, Central Province, in March.

The Bark-eating Borer (*Arbela quadrinotata*) was reported in January from Kotagala, Central Province.

Ricanoptera opaca—an apparently new pest of tea—made its appearance in Madulsima (Province of Uva) in May. The outbreak of this plant-bug apparently only lasted a short time.

Lecanium viride was reported from tea at Bandarawela (Province of Uva) in August. Examined in September : a few bushes in small acreage (30 acres) were found to be attacked.

During the unusually long drought which prevailed over most of the tea districts in the early part of the year, the tea mites were much in evidence, though but few reports were received. The coming of the rains put a stop to their activities.

The Purple Mite (*Phytoptus carinatus*) was apparently the commonest, but also disappeared with the rains.

Psocidæ.—A curious case of infestation of made tea by these insects, which are allied to "termites" or "white ants," was received from a Colombo firm in November. The matter is still under investigation, but it seems probable that the insects were originally present on the wood of the tea chests, and obtained admittance to the tea before packing or through perforated tea lead.

Rubber.

No serious pests have been recorded. During the months of January and February, Hevea trees were attacked by a small bark-eating caterpillar of the moth *Comocritis picria* at Kegalla, Province of Sabaragamuwa ; Neboda, Western Province ; Puwakpitiya and Parakaduwa, Province of Sabaragamuwa. This insect eats shallow depressions in the bark and spins a web over itself, which is covered with fragments of the bark. In general little damage is done.

Acacia.

Icerya purchasi (The Fluted Scale Insect).—This insect was first observed on *Acacia decurrens* and on *Acacia melanoxylon* in the Agrapatnas (Central Province), and about the same time on *Casuarina* at Peradeniya (Central Province). Since, it has been sent in from Lindula, Agrapatnas, In June, and a very heavy attack has occurred over a considerable area in Ambawela. It is present in small numbers at Galaha (Central Province). Doubtless it has been in the Island for some time ; but this year, for the first time, it has become noticeable. It is a notorious pest of citrus in California, and occurs on *Acacia mollissima* in South Africa. Attempts are being made to keep the insect in check.

Attention is being paid to the prevalence of the large land snail in the Kandy District, and improvements in the sanitary conditions of the residential quarters at Nuwara Eliya have been recommended with a view to helping to reduce house flies.

EDWARD R. SPEYER.
February 1, 1917. Acting Entomologist.

REPORT OF ENTOMOLOGIST IN CHARGE OF INVESTIGATIONS INTO SHOT-HOLE BORER OF TEA.

VISITS TO ESTATES

The following tea estates were visited :—

Province of Uva.

1. Poonagalla group, Bandarawela
2. Macaldenia estate, Koslanda.
3. Sarnia group, Badulla.
4. Elmshurst estate Badulla.
5. Yelverton estate, Badulla
6. Napier Estate, Demodara.

Central Province.

7. Castle Milk estate, Gampola
8. Orion estate, Gampola.
9. Hindford estate, Nawalapitiya.
10. Amblamana estate, Galaha.
11. Bellwood Estate, Galaha.

11*a*. Moragalla estate, Galaha.

Province of Sabaragamuwa.

12. Balangoda group, Bogawantalawa.
13. Keenagaha Ella estate, Bogawantalawa
14. Denegama estate, Bogawantalawa.

Reports were written upon Nos. 1, 2, 3, 4, 5, 7, 10, 12,13, and 14. Experiments were carried out upon Nos. 1, 11, 12, 13, and 14.

CONTROL SCHEME.

It comprises (1) the cutting off of all branches which do not put out new shoots two to four months after pruning ; (2) the pruning of infested bushes at stated times after the original pruning.

Two fields have been treated by the first method on the Poonagalla group. On one a marked improvement in the decrease of the borer has been noted, which is probably in part due to the treatment, and in part to heavy manuring with cattle bulk. The other has just been completed. 100 per cent. of the branches removed contained galleries of the insect.

On the Moragalla estate, Galaha, a field was similarly treated. Here 50 per cent. of the branches contained galleries. The result will not be apparent for eighteen months. The second method has been exploited on a field of 67 acres on the Denegama estate. The infestation was small at the start, but the superintendent of the estate gives information that the ravages of the insect have at any rate been temporarily checked. On a field of 26 acres on the Poonagalla group the number of infected bushes in January-February, 1916, was 16 per cent. at the time of treatment. The second pruning carried out in January, 1917, involved the pruning of approximately 14 per cent. of the remaining bushes, leaving an approximate infestation of only 4 per cent. 2½ years after the original pruning. On fields which are run three years between prunings the scheme will require modification. An area of 100 acres is at present receiving treatment on the Moragalla estate, Galaha. This is run on the two years' system.

A circular embodying a projected control scheme was submitted to the Committee of Agricultural Experiments and the Planters' Association. The control scheme has been carried out on—

1. Poonagalla group : 38 acres in part completed.
11*a*. Moragalla estate : 300 acres *in toto* in progress.
14. Denegama estate : 67 acres in part completed.

Total... 405 acres

The scheme is now to be carried out on Sarnia group, Badulla ; Elmshurst estate, Badulla ; and Yelverton estate, Badulla.

Lectures on the shot-hole borer pest of tea have been given to the Pussellawa, Hewaheta Nuwara Eliya, Uda Pussellawa, and Ramboda Planters' Associations.

The Treatment of Prunings.—A systematic examination was made of tea prunings buried with basic slag and sulphate of potash on the Keenagahaella estate, Balangoda. It was found that up to two months after burying prunings to a depth of 1 foot 6 inches the insect was still breeding underground, and negative evidence was forthcoming that the beetles were finding their way to the ground surface. Upon this and previous investigation the system of burying prunings on estates has been deprecated, and the burning of the woody parts of prunings has been advocated. On the Poonagalla group it was found both economic and advantageous to fork in the leaves after cutting them from the prunings and burn only the woody parts. Observations were made upon the effect of breaking the branches attacked by the borer and leaving these attached to the bushes. After fourteen days living insects were found in these branches below the point of rupture. The exposure of portions of the galleries of the beetle, therefore, does not hinder the development of the insect in other parts not exposed.

Painting Tea Bushes.—The results of an experiment made in October, 1915, with resin mixture, were obtained. Twelve washes made up of varying proportions of resin, soda, creosote, fish oil, and carbolic acid had been applied to plots of fifteen newly pruned tea bushes. Four of these were found to be too thin in composition to protect the wood from the borer. The others were satisfactory in as far as they formed a varnish, which would definitely prevent entry or emergence of the insects. Six of the remainder washed off too easily with the monsoon rains. This left two, which were temporarily satisfactory. Examined in January, 1916, four months later, the bushes thus treated were making no growth, so that the experiment was not proceeded with. However, in January, 1917, these bushes were found to have recovered completely, and further experiments are being made with the preparation of washes, which may act as protections to the young buds.

Castor Oil Tree (*Ricinus communis*).—An experiment was arranged under canvas to determine if the castor oil tree could be used effectively as a trap for shot-hole borer. Tea bushes were transplanted and placed with unaffected castor oil trees in October, 1915. In January, 1916, the castor oil trees were heavily attacked, but the infestation had not been reduced in the tea bushes. It is therefore, concluded that the castor oil tree will not be satisfactory as a trap for the borer.

Shot-hole Borer in Grevillea and Dadap.—Experiments were carried out on the Poonagalla group to determine what species of Scolytid beetle attacked the surfaces of grevillea trunks after removal of the bark. After eighteen days 31 beetles were extracted from the cut surfaces, 23 specimens of *Xyleborus semigranosus* (?), 7 specimens of *Xyleborus semiopacus*, and only 1 specimen of *Xyleborus fornicatus*, true shot-hole borer. The latter insect, however, was found to attack dadaps at the point of "ringing" in profusion, and the burning of the ringed surfaces four to forty days after this practice has been recommended.

EDWARD R. SPEYER,
Entomologist in Charge of Shot-hole
Borer Investigations.

January 31, 1917.

III.—SUMMARY REPORTS ON THE WORK OF THE CHEMICAL DIVISION.

GOVERNMENT CHEMIST.

The analytical work during the year included an investigation into the chemical composition of the soils where tea plants were most affected with shot-hole borer, tobacco and other soils, manures, cattle foods, waters, and ashes of various jungle and other plants as possible sources of potash; also analyses of dolomitic and other limestones, &c.

ANALYSIS OF RUBBER TREE.

A complete analysis was also made of the ash of a Para rubber tree eleven years old, and measuring 34 inches at 3 feet from the ground. The measurements and weight of the various parts of the tree and the crude ash were kindly supplied by Mr. Grimwood of Panagula estate, Waga, and are recorded below :—

The weight of the trunk of the tree was 820 lb., which yielded 13 lb. of crude ash, and the branches and leaves 305 lb., yielding 19 lb. of crude ash. The total weight of the air-dried tree was 1,125 lb., or practically half a ton, containing 32 lb. of crude ash, or 11·40 lb. of *pure* ash, equal to 1·01 per cent. At 100 trees per acre this would represent 1,140 lb. of pure mineral matter absorbed during the eleven years of growth, or nearly 104 lb. per annum.

The ash consists chiefly of carbonates and phosphates of lime, potash, and soda, the phosphoric acid being about one-third of the lime and one-half the potash content. The soda content is higher than the potash, which is unusual, and would indicate a deficiency of available potash in the soil in which the tree was grown.

The ash of the leaves forming about 50 per cent. of the total ash of the tree would be returned to the soil in the annual leaf-fall, and if the leaves are buried would be utilised indefinitely.

The average amount of lime, magnesia, potash, soda, phosphoric, and sulphuric acids used annually by 100 trees per acre are :—

	lb.		lb.
Lime	21·3	Soda	15·8
Magnesia	6·6	Phosphoric acid ...	7·3
Potash	13·1	Sulphuric acid ...	2·8

The ash of Hevea latex is rich in potash and phosphoric acid, viz., 43 per cent. and 24 per cent. respectively, much of which could be restored to the soil in the latex water if run over the land, instead of down the nearest ravine.

Air-dried mature Para bark contains 5·25 per cent of *pure* ash, of which 41·8 per cent. is lime, 9·3 per cent. potash, and 3·20 per cent. phosphoric acid.

PRODUCTION OF POTASH FROM JUNGLE IN THE NORTH-CENTRAL PROVINCE.

In 1912-13 7,912 tons of concentrated potash salts were imported into Ceylon, chiefly from Germany, also 2,082 tons of nitrate of potash from India. These manures contained about 8,800,000 lb. of potash of which about 4,200,000, or 4·57 per cent. are exported annually in tea alone. With the war the importation of potash salts practically ceased, and stocks were soon exhausted.

To investigate possible supplies of potash several varieties of leaves and branches of jungle trees and shrubs in the dry zone were collected. Complete analyses of the leaves and branches of ten varieties typical of the forest in the Vavuniya District were made to determine the potash and other valuable manurial constituents, with a view to supplying the demand for potash in the tea, rubber, and coconut districts.

The percentage of ash in the various plants varied from 3·5 to 6·1 per cent. on the partly dried material. The colour of the ashes were light gray, through different shades, to a dark blue-gray. Some had a distinctly pink tinge. The potash content calculated on the *pure* ash free from carbon and sand ranged from 6·7 per cent. to 23·5 per cent., and averaged 13·26 per cent. on the ten varieties, or 10·88 per cent. on the ashes as ordinarily burned. The lime content varied from 21·2 to 41·6 per cent., and averaged 30·2 per cent. Phosphoric acid ranged from 2·18 to 6·66 per cent. on the ordinary ash, averaging 3·90 per cent. Taking the average percentages on these plants as—

	Per Cent.
Potash	10·88
Phosphoric acid	3·90
Lime	30·20

the value of the ash at pre-war prices would be approximately Rs. 70 per ton, allowing the following values per unit (1 per cent. per ton), viz., potash Rs. 3·60, phosphoric acid Rs. 5, and lime 40 cents.

In practice, where a larger proportion of branchwood would be included, the yield of potash and phosphoric acid would be less, and one experiment conducted by Mr. Sargent of the Forest Department gave the following results :—One square chain of jungle tops were burned yielding 1½ cwt. of ash, containing 31 per cent. lime, 6 per cent. potash, and 2 per cent. phosphoric acid, and was worth Rs. 44 per ton.

A second experiment on 2 acres of jungle, from which the firewood had been removed, yielded only ¾ ton of pure ash per acre of approximately the same composition.

As the bulk of the ash (and potash) is in the younger branches and leaves, the more scrubby and leafy the jungle, the better should the yield of ash be. There are large areas of such jungle available which could be utilized for the production of potash with advantage, as, owing to unfavourable climatic conditions, they are never likely to be utilized agriculturally.

Other ash analyses were also made, including that from tea driers, where eucalyptus was the chief fuel used. It contained 24 per cent. of lime, 8·5 per cent. potash, and 2·2 per cent. phosphoric acid, and was worth Rs. 49 per ton.

Artemesia vulgaris (Wormwood) a plant commonly grown as a fence around cooly lines about 5,000 feet, is rich in potash, the analysis of the sun-dried specimens giving 7·1 per cent. of ash containing 14·4 per cent. lime, 37·8 per cent. potash, and 7·6 per cent. phosphoric acid, and worth Rs. 180 per ton.

A potash salt obtained by burning coconut husk contained 26·7 per cent. of potash, and was worth Rs. 102 per ton. It is doubtful whether it would pay for coconut estates to sell the husk for ash production.

LIME.

Owing to the rise in the price of lime and the difficulty of getting it well burned for use on estates, several samples of dolomitic limestone were analysed from different outcrops.

The composition varied considerably, some being fairly pure crystalline limestones with a small percentage of magnesia, others containing a large proportion of that constituent rendering it unfit for agricultural purposes.

Some of the limestones, although showing a good crystalline appearance, contained a large proportion of pure quartz, so that precautions should be taken to see that the limestone is suitable before erecting kilns for burning.

The ordinary coral lime as supplied to estates is generally fairly pure, but frequently is badly burned, the fuel used being poor and insufficient to obtain the necessary temperature. Sprinkling the coral with liquid fuel would improve the burning, but at present the latter is too expensive.

POONAC.

Several samples of coconut poonac were analysed for food and manurial purposes. As a rule, it is too valuable to be employed as manure, but owing to want of freight, &c., the question of using the surplus as a manure was considered. Ordinary coconut poonac contains the following manurial constituents :—

	Percentage.	lb. per Ton.
Nitrogen	3·33	74·5
Phosphoric acid	1·47	32·9
Potash	1·29	28·8
Lime	0·90	20·2
Sodium chloride	1·17	26·2

The value in Colombo as a manure, taking into consideration all constituents, is about Rs. 65 per ton.

Castor cakes as now imported are less rich in nitrogen than formerly, the present guarantee being only 4½ to 5 per cent., against 6 per cent. Complete analysis of the plant, including stems, leaves, husk, and seed, showed that the sun-dried leaves contain almost as much nitrogen as the fresh seed, viz., 2·56 per cent. The ash generally of all the parts is rich in lime, potash, and phosphoric acid, that of the husk containing 36·80 per cent. potash and 11·50 per cent. phosphoric acid, while the ash of the dried stems has 29·6 per cent. As recommended before, this plant might well be grown in the North-Central Province or other parts of Ceylon, away from the tea districts, for the seed and potash, &c., contained in the stems and husks.

Sunflower is another plant whose stems are rich in potash, containing about 2 per cent. The giant Russian sunflower and other varieties grow luxuriantly in the North-Central Province and other districts in Ceylon, the seed containing 25 to 28 per cent. of a valuable oil. Unfortunately the heads, although well formed, contain a low proportion of fertile seed owing to the scarcity of fertilizing insects, such as honey and humble bees.

TOBACCO.

Determinations were made of the chlorine and potash contained in the Sumatra and White Burley varieties of tobacco grown in Jaffna, the former having a very deleterious effect on the keeping and smoking qualities of the finished leaf. The following figures are of interest for future comparison with the same varieties grown in more inland districts :—

	Sumatra Leaf. Per Cent.	White Burley Leaf. Per Cent.
Moisture	24·00	22·80
Organic matter	61·16	57·56
*Ash	14·84	19·64
	100·00	100·00
*Chlorine	2·19	2·16
Potash	0·99	1·09

PRODUCTION OF CHARCOAL AND ACETIC ACID AND POTASH.

Suitable sites for charcoal manufacture were selected, but owing to the war the necessary plant and copper condensers could not be imported from England. The cost of boiler plate locally is also very high, so that conditions have not been favourable for the erection of a distillation plant to yield remunerative results.

M. KELWAY BAMBER.

February 27, 1917. Agricultural Chemist.

RUBBER RESEARCH CHEMIST.

From January to July was spent in collecting data on "bark" renewal of rubber trees at Peradeniya, and also in the examination of sections of cortex. From August-December rubber samples were prepared in the Kalutara District, and investigations into the composition of rubber latex were carried out. Part of the analytical work was done in the laboratory of the Government Analyst, Colombo.

RUBBER PREPARATION.

The year 1916 has brought the investigations into the effects of various ways of preparing raw rubber to a definite stage. It has been found that acetic acid is quite satisfactory as a

* Calculated on the pure ash, the chlorine amounted to 14·70 and 10·98 per cent., respectively.

coagulant as far as the physical properties of the vulcanized rubber are concerned, and that at present there would appear to be no advantage in using any other coagulant in its place. Plain unsmoked sheet rubber has been found to be usually of excellent quality, smoking of sheet rubber increases the time of vulcanization considerably; and crêpe rubber invariably takes a much longer time to vulcanize than the corresponding sheet. Rubber, which is allowed to remain in the wet condition after coagulation, appears to be invariably quick curing. Rubber loses some protein on washing period. It may be said that the causes of variability in plantation rubber are beginning to be understood.

LATEX VESSELS.

In co-operation with the Assistant Botanist and Mycologist a series of investigations into the occurrence of latex vessels at different heights of the *Hevea brasiliensis* tree were carried out at different times of the year and in cortices of various thickness. These investigations showed that there are considerable differences in the numbers of latex vessels present at different heights of the tree. The maximum number was at the base, and decreased, often rapidly, with the height above ground level.

Usually there was a considerable difference between the number of rows of latex vessels at ground level and that at 4 feet above it. Thick untapped cortex usually contained more latex vessels than thin untapped cortex, though this difference was not very great.

The average of a number of measurements of the thickness of the *inner cortex* was 1·5 millimetres, or approximately 1/16 inch. This should not be pared in tapping operations. It has been found that on well-tapped estates this condition is usually complied with.

"BARK" RENEWAL

A large number of measurements of "bark" renewal have been made, which will be published later.

COMPOSITION OF LATEX.

The agencies which produce the clotting of latex have been investigated. Analyses have also been carried out to determine any variations that many occur in the chemical composition of latex from the same tree at different times.

PUBLICATIONS.

Four bulletins have been issued to subscribers to the Ceylon Rubber Research Scheme. Three Reports on vulcanization tests made for the Research Scheme by the Imperial Institute have been issued departmentally.

L. E. CAMPBELL.
January 29, 1917. Rubber Research Chemist.

IV.—SUMMARY REPORT ON THE WORK OF THE DIVISION OF LOW-COUNTRY PRODUCTS AND SCHOOL GARDENS.

LOW-COUNTRY PRODUCTS.

The coconut crop of 1916, owing to the good rainfall of the previous year, was from 10 to 30 per cent. larger than that of 1915. The extension of coconut cultivation was not carried on very largely owing to the war. From two to three thousand acres were opened up during the year.

During the year the cinnamon industry suffered very severely owing to low prices, and there was no market at all for the finer grades of quills. The prices for ordinary grade quills ranged from 25 to 30 cents per lb., which is more or less the cost of production. A large area of cinnamon has been uprooted to make way for coconuts and rubber. In the Negombo District alone about 500 acres were so uprooted during the year.

In purely native agriculture more or less normal conditions prevailed.

GOVERNMENT STOCK GARDEN.

The Government Stock Garden in Colombo, which was established since the inception of the School Garden Scheme, had to be abandoned in May last, and a new one was established at Peradeniya Junction at the old Silk Farm, which is now held on lease from the Railway Department.

The work of laying out and raising nurseries, as well as the transport of all useful and necessary material to the new Stock Garden, were carried out during the year.

Approximately 3,670 packets of seeds and 1,591 economic and ornamental plants were distributed during the year to school gardens.

SCHOOL GARDENS.

The total number of school gardens at the end of the year was 327, or 40 more than last year, in addition to which there were 57 grant-in-aid schools which had to be examined for the

Government grant. Fifty-five school gardens were provided with implements during the year and 21 with fencing. The majority of school gardens continue to maintain a high standard of efficiency, and teachers and pupils have worked to maintain the gardens in good condition.

Number of schools which received grants of	Rs. 30 each	...	13
Do. do.	„ 20 „	...	33
Do. do.	„ 15 „	...	62
Do. do.	„ 10 „	...	52
		Total ...	160

ALEX. PERERA,
Acting Superintendent, Low-country Products and School Gardens.

January 30, 1917.

V.—SUMMARY REPORTS OF WORK OF DIVISION OF BOTANIC GARDENS.

ROYAL BOTANIC GARDENS, PERADENIYA.

The rainfall during the year was 7½ inches below the average of the past thirty-three years. The month of February was entirely rainless, which, following upon a dry January, made its effect marked upon the vegetation of the gardens.

CEYLON LAWN GRASS.

With the object of defining to some extent the value of various species of Ceylon grasses suitable for lawns, fifteen beds, each averaging 30 feet by 5 feet, have been made and planted upon the site of the old sugar cane plot in the south garden. Each bed is kept mown, and instructive and interesting results will become available.

PALMETUM.

Additions of recently introduced species of palms have been planted in duplicate in their respective groups of the Palmetum. Other species new to these gardens are being raised. The cuttings of *Gliricidia maculata*, inserted for shade purposes, appear to answer the purpose well. The favourable weather experienced throughout has enabled the palms planted to make rapid progress, and very few deaths have occurred.

CONIFER COLLECTION.

A number of conifers were planted to supplement the existing collection in the south garden. It is extremely difficult to establish these at Peradeniya, but most of the plants are thriving.

LAKE.

Additional seedlings of the giant water lily, *Victoria regia*, have been planted on prepared mounds in the lake. Seedlings put out in September last year flowered in February last and seeded in June and July.

The water weed, *Hydrilla verticillata*, previously one of the greatest of pests, has been entirely eradicated from the lake, presumably by the Gourami fish.

FIBRE COLLECTION.

The old rockery near the lake has been re-planted with the principal fibre plants, including Sisal hemp, Bowstring hemp, Sunn hemp, Manilla hemp, Mauritius hemp, Ramie fibre, pineapple fibre, &c.

DRY REGION TREES.

Particular attention has been devoted to planting trees indigenous to the dry regions of the Colony, with a view to establishing a compact collection. These have been planted out on the area surrounding Gardener's Memorial, probably one of the driest parts of the gardens.

FERNERY.

Many of the beds had become overgrown with Selaginella and other undesirable plants. These beds have been cleared and re-planted with a variety of ferns, both indigenous and foreign.

The collection of ferns indigenous to Ceylon have also been considerably enlarged, and many of the up-country species established.

CODIÆUM (CROTON) COLLECTION.

A number of named varieties brought out from England in 1913 have been successfully layered and planted out in duplicate at the north end of the flower garden.

FRUIT PLOTS.

The vacant plot situated between the flower garden and vegetable collection has been utilized for planting up with fruit trees. These include grafted citrus, mangosteen, sapodilla, and loquat. Other fruit trees now established here include Ceylon gooseberry, hill guava, cherimoyer, mangosteen, grape, fig, &c. Particular attention is being devoted to these plants, as it is felt that much can be done in the improvement and spread of fruit cultivation in the Island.

EXTENSION OF NURSERIES.

With the increasing demands for ornamental, flowering, and foliage plants, it has been found necessary to enlarge the existing nurseries. Part of the present economic nursery was given over to the propagation of plants for planting at the new Government bungalow compounds at Colombo.

ARBORETUM.

The botanical collections in the Arboretum demand an increasing amount of attention each year, many interesting and new species having been added during the year, notably—

Afzelia bijuga..	Gustavia augusta.
Artocarpus odoratissima.	Hura crepitans.
Castanopsis argentea.	Peltophorum Vogelianum.
Dialium guineense.	Piptadenia communis.
Dimophandra Mora.	Pterogyne nitens.
Erythrina Vespertilio.	Tiunana speciosa.

LABELLING.

Progress in labelling has been continued. Some 1,800 labels mostly brick, were put out during the year.

ROADS.

The maintenance of the paths and roads absorb a large amount of labour, and difficulty is experienced in keeping these up to the desired standard. The whole of the main drive and Trimen's drive have been re-gravelled and shaped during the year.

VISITORS.

The number of visitors, mostly from abroad, who signed the Visitors' Book during the year is 1,848. This shows a considerable decrease on last year's figures.

INTERCHANGE OF PLANTS AND SEEDS.

The amount realized by sale of plants and seeds for the year is Rs. 2,804·53.

Seventy-eight plants and 306 packets of seeds from foreign Botanic Gardens, Departments of Agriculture, &c., have been received during the year.

14,129 plants, including 8,076 supplied for the Colombo bungalow gardens, and 509 packets of seeds, valued Rs. 2,823·50, have been issued gratis or in exchange.

The following are the principal species introduced or re-introduced during the period under review :—

Afzelia bijuga (Agricultural Experimental Station, Madagascar).
Ceroxylon andicolum (Department of Agriculture, Bogota).
Clerodendron floribundum (Miss Tilly, Talawakele).
Coccoloba uvifera (Agri-Horticultural Society, Madras).
Congea tomentosa, var, azurea (Agri-Horticultural Society, Madras).
Erythrina Vespertilio (Miss Tilly, Talawakele).
Gymnosporia Rothiana (Agri-Horticultural Society, Calcutta).
Korthalsia polystachya (Botanic Gardens, Singapore).
Liquidambar formosana (Experiment Station of Forestry, Taihoku, Japan).
Mussaenda luteola (Agri-Horticultural Society, Madras).
Orbignya Lydiæ (Botanic Gardens, Buitenzorg, Java).
Peltophorum Vogelianum (Botanic Gardens, Paramaribo, Dutch Guiana).
Pinanga Kuhlii (Botanic Gardens, Singapore).
Piptadenia communis (Botanic Gardens, Paramaribo).
Ptychandra glauca (Botanic Gardens, Buitenzorg, Java).
Schinus terebinthifolius (Ministry of Agriculture, Egypt).
Sideroxylon ferrugineum (Experiment Station of Forestry, Taihoku, Japan).
Sterculia Trichosiphon (Miss Tilly, Talawakele).
Terminalia cycloptera (Ministry of Agriculture, Egypt).
Tipuana speciosa (Botanic Gardens, Paramaribo).
Zelkova acuminata (Experiment Station of Forestry, Taihoku, Japan).

HORTICULTURAL DEMONSTRATIONS.

Demonstrations in horticulture have been given to the students of the School of Tropical Agriculture throughout the year.

T. H. PARSONS,
Curator.

January 27, 1917.

HAKGALA BOTANIC GARDENS.

THE number of inches of rain recorded during the year was 84·47, falling on 227 days, compared to 104·15 inches on 263 days for 1915. The wettest month was May, with a rainfall of 15·54 inches ; and the driest-February, with a fall of ·96 inch.

The highest temperature in the sun's rays was 151·1 on April 2, compared to 152·1 on April 8 of the previous year. The lowest temperature on the grass was 38·3 on February 4, compared to 39·8 on January 31 of the previous year.

SUMMER ARBOUR SURROUNDINGS.

All the old Acacia trees and stumps were removed and the ground levelled and turfed over. A retaining wall 4 feet high and 40 feet long was built on the south-east side to make the lawn as level as possible. Hedges of Box, *Cupresses macrocarpa*, and *Cryptameria japonica* have been planted on the south-east, west, and north sides, respectively. All the banks around the arbour have been re-sloped and turfed over.

LOWER OAK PLOT.

All the poor specimens were taken out, the grass bank re-turfed, the ground levelled, and the path re-paved and put in order. A large number of ornamental and flowering shrubs have been planted. A few branches of the trees below the plot were lopped in order to open up the view from the lower drive.

THE FERNERY.

Most of the tree ferns were damaged during the monsoon. The long border on the right of the path forming the east entrance to the fernery has been devoted to a collection of Ceylon ferns, and so far about 75 kinds have been planted. A portion of the border has been set apart and planted with Lycopodiums and filmy ferns. All the beds and borders have been thoroughly overhauled and planted. A large number of Orchids, Lycopodiums, &c., have been put out on the trees and in hanging bamboo sections. The main path has been widened, and is now of a uniform width throughout.

THE UPPER LAKE.

The path and bank round this have been re-turfed with *Paspalum dilatatum*. The shrubbery above the pond has been planted up with various ornamental and flowering shrubs and lilies. The retaining walls of the beds around the edge of the pond have been rebuilt and re-planted with Crinums, Callas, Phormium, *Musa coccinea*, Papyrus, &c. The trout received from the Ceylon Fishing Club in 1914 are growing well, and a few are now over 2 lb. in weight.

THE FLOWER GARDEN.

The long border in front of the bungalow has been widened. A new lawn has been made near the orchid house and suitable shrubs planted.

ECONOMIC.

A $\frac{1}{48}$-acre plot planted with hickory king maize on December 3, 1915, was harvested during the first week in June, 1916, the yield working out at $13\frac{3}{4}$ cwt. per acre. As the wind damaged the plants during the ripening period (end of May), a small plot was planted with selected seed on October 20 last, and is growing satisfactorily.

Experiments with *Solanum Commersonii* were continued. The last crop (planted in August) was harvested on December 6, and yielded at the rate of $2\frac{1}{5}$ tons per acre. All the tubers from this crop have been kept for seed purposes.

The trees of *Acacia mollissima* (Black Wattle) in all the three patana plots are growing well. A few of the small trees in Plot C were damaged by sambur during December. The growth in all the plots has averaged about one foot per month.

A crop of the "cluster" and three common varieties of sweet potato was harvested on May 4. The "cluster" yielded at the rate of 105 cwt. per acre. The common varieties, purple, hastate-, and cordate-leaved, yielded at the rate of 168 cwt., 273 cwt., and 399 cwt., per acre, respectively.

A small plot of *Physalis peruviana* (Cape Gooseberry) has been planted in the experiment plot, and the plants are growing and fruiting well.

The row of plants of Manila hemp (*Musa textilis*) in the experiment plot are not growing satisfactorily.

The small trees of Tagasaste (*Cytisus proliferus*) in the plot below the plant sheds flowered during October-December. Cattle do not seem to be fond of this fodder.

100 bulbs of *Stachys tuberosa* (Chinese artichoke) were received from the Secretary, Ceylon Agricultural Society, in January and planted on 10th. The plants grew well, but have not yet been dug up.

The Chinese date plum (*Diospyros Kaki*) tree near the summer arbour produced a good crop during September. All the fruits were seedless.

Three plants of the *Kokia Rockii* were planted in sheltered positions near the Students' gardens. The plant on the lawn near the succulent collection is about 5 feet high, and has started to branch.

A small tree of *Sapindus Saponaria* (Soap Berry) near the laboratory fruited for the first time in March. All the seeds were collected and sown, but have not yet germinated.

A few fertile seeds of *Araucaria Bidwillii* (Bunya Bunya pine) were collected during July and August. Only two or three seeds were found in each cone.

VISITORS.

The number of visitors during the year was 2,000.

JAMES J. NOCK,
Curator.

January 29, 1917.

NUWARA ELIYA GARDENS.

THE FLOWER GARDEN.

A good show of flowers was kept up during the season. Among the flowers that succeeded best were phlox, sweet peas, carnations, nemesias, rodanthe, &c. The border along the main drive has been widened, and the wire fence removed from the front. The border along the upper path has been overhauled and planted up with suitable shrubs, lilies, &c.

THE FERNERY.

All the plants of lilies, &c., in the rockery at the south end of the garden have been removed and a collection of Ceylon ferns substituted.

EXPERIMENTS.

The *Acacia mollissima* plants put out in 1915 are growing well, and one of the trees produced a few flowers in December.

Cytisus proliferus seems to do very well, and the plants are now in flower. Seed will be collected and sown.

LABOUR.

It is very difficult to induce coolies to stay in the garden in consequence of the higher wages that are offered for private gardens.

JAMES J. NOCK.

January, 29, 1917. Curator.

HENARATGODA BOTANIC GARDENS.

There was a drought in the months of January and February, but taking the year as a whole it was satisfactory for planting.

PLANT HOUSES.

The pot plants were re-potted twice during the year. Many plants were lost during the drought of January and February owing to shortage of water. Various kinds of palms and other plants have been prepared in bamboo pots.

FERNERY.

Several beds of the fernery were forked. The mock rock dagoba was reconstructed and planted with ferns.

ROADS, PATHS, AND DRAINS.

The road leading to the Minuwangoda road from the entrance gate was widened during the year. The main drive has been levelled, and the circular road re-gravelled. Most of the culverts were repaired during the year, and three new outlets were constructed on the lower portion of the circular road.

PLANTS IN FLOWER, &C.

The double coconut (*Lodoicea callipyge*) attracted a good deal of attention. This is the only female plant flowering in the Island, and pollination has to be artificially carried out by pollen from the male flowers of a plant at Peradeniya. At present there are two matured fruits on this plant, together with several other smaller ones growing.

ECONOMICS.

Various tapping experiments with rubber are being carried out. A new series of a single cut *versus* two cuts was commenced in September.

The new planted plot of 5 acres of Para rubber interplanted with *Tephrosia candida* as a green manure is making satisfactory progress.

A small nursery of Ipecacuanha plants (*Psychotria Ipecacuanha*) has been carefully planted out. This stock of plants has been raised from a few procured three years ago, and appear to succeed satisfactorily. There is a good demand for plants.

D. F. DE S. GUNARATHNA,

January 9, 1917. Conductor.

GOVERNMENT HOUSE GARDENS, COLOMBO, KANDY AND NUWARA ELIYA.

HIS EXCELLENCY THE GOVERNOR'S GARDENS.

The condition of the grounds at Queen's House, Colombo, has been improved during the year. Re-turfing of the worn patches on the lawns and verges has considerably improved the general appearance of the garden. The long border near the boundary wall has had additional flowering trees planted in it.

The garden at King's Pavilion, Kandy, has been maintained in a satisfactory condition. Beds, borders, and shrubberies were manured, and worn places in the lawns re-turfed. The vacant plots behind the stables were planted up with Mauritius and Guinea grasses, with the object of meeting the supply of fodder necessary for the Bodyguard horses when stationed here.

The garden and grounds at Queen's Cottage Garden, Nuwara Eliya, have been kept in good order during the year. A few of the flower beds in front of the house were removed and turfed over. A wire-netting fence has been put up along the drive in front of the house in order to keep out hares. A large number of cupressus plants have been planted along the side of the old drive.

The fence around the vegetable garden has been put in good order and three new plant sheds erected. Sambur entered the garden on several occasions and did a certain amount of damage.

"Club-root" is still very troublesome, and very few cruciferous vegetables can be grown successfully. Practically the whole of the garden is infected with the disease.

A good water supply is badly needed, and a considerable amount of labour is taken up during the dry weather for watering, as the water has to be carried long distances. The present supply, from a small stream in the jungle, is quite inadequate.

GARDENS ATTACHED TO RESIDENCES OF THE COLONIAL SECRETARY.

The garden attached to Temple Trees, Colombo, was taken over by this Department in October, and improvements have been commenced in many directions.

The general upkeep of the garden at The Lodge, Kandy, has been maintained, and several minor changes are being undertaken.

The garden attached to Cuddesdon, Nuwara Eliya, has been kept in fair order and certain improvements begun.

T. H. PARSONS,
Curator, Royal Botanic Gardens.
JAMES J. NOCK,
January 29, 1917. Curator, Hakgala.

GOVERNMENT BUNGALOW GARDENS, COLOMBO.

The supervision of the laying out of the compounds of the new Government bungalows in Buller's road, Colombo, was undertaken in May. Favourable weather has been experienced, and thirty bungalow compounds, out of the forty-five, for which funds were allotted were practically completed within the year.

8,076 plants have been supplied from Peradeniya for the planting up of hedges, shade trees, &c.

Roadside planting along the new roads has also been undertaken.

T. H. PARSONS,
January, 29, 1917. Curator, Royal Botanic Gardens.

VI.—SUMMARY REPORTS ON WORK OF EXPERIMENT STATIONS.

PERADENIYA EXPERIMENT STATION.

In February no rain was recorded, while in June (the wettest month) 13·67 inches were recorded.

TEA.

The total output of green leaf for the year was 50,660 lb. from 15 acres, of which 4 acres interplanted with Hevea rubber were uprooted in August. Plot 155 (cattle manure) has given the highest yield, 5,340 lb. in green leaf equal to 1,290 lb. made tea per acre. The highest price paid for broken orange pekoe was 58 cents per lb.

Plots 146-150 (Manipuri indigenous) were pruned in January, leaving a live branch to carry the bushes through the dry weather.

In plots 144 and 149 the dadaps have been cut, yielding 8,518 lb. and 8,131 lb. green material per acre, respectively. In plot 150 the Albizzias were cut once, yielding 8,540 lb. per acre.

Seedlings of Assam hybrid and Manipuri indigenous have been planted to fill up vacancies. The plants were shaded with ferns, and the majority are growing well. The seeds were supplied, free of charge, by the Horagalla and Syston estates.

CACAO.

In November the highest price for the year, viz., Rs. 59·50 per cwt., was obtained in Colombo for unselected cacao. Owing to the low prices ruling at the end of the year, the crop for the latter part remains unsold.

An experiment in claying black cacao with Indian red clay (Cavi) was carried out, and cacao thus treated fetched Rs. 42 per cwt. in Colombo, or only Rs. 10 less than the best quality sold.

Several new manurial experiments have been initiated. 33 acres of old plots divided into three series of 11 acres each were manured. 4 acres of 8-year old cacao, marked B, were divided into 16 small plots to determine the effect of correcting, by lime, the acidity of fell upon the influence of nitrogenous manures, and were limed and manured according to the scheme sanctioned by the Committee of Agricultural Experiments.

Several experiments in despatching and packing cacao seed to Kuala Lumpur were tried. Pods packed in dry charcoal gave the best result, 87 per cent. of seed having germinated.

Two rounds of canker treatment and suckering were completed. Bark canker was not so prevalent as last year.

All dadaps have been severely lopped to reduce again their height and density of shade.

RUBBER.

All the experiments in tapping as detailed in the last annual report have been continued, in addition to the following new experiments started during the year :—

Twenty trees (8-year old) in tea were tapped for the first time on a third, one cut to left at 15 inches from the ground, on alternate days. The yield of each tree is being kept separately.

Plot 82 B (11-year old rubber). One row, previously tapped in 1910-13, was divided into three sections and tapped at different stages of bark renewal, as follows :—A third, 1 cut to left at 15 inches from the ground. Yields of each section are being kept separately.

A series of experiments with a view to preventing further development of bark rot were begun.

Trees under rubber manuring experiments have been dressed with various mixtures, the manures being applied in a trench dug between the rows.

The 2-acre plot (73—76) planted in avenues 40 feet by 15 feet by 15 feet in June, 1913, has been manured according to the scheme laid down.

All the manured plots have had small drains dug between the avenues of Hevea trees to prevent the possibility of surface roots absorbing any of the manure mixtures applied to other trees.

Tephrosia candida has been cut and mulched for the seventeenth time since sowing in 1913. Plants of this leguminous cover crop on the hillside plantation are attacked by a root disease (*Poria hypobrunnea*) and a scale insect (*Ceroplastodes cajani*). The trees affected were uprooted and burnt.

COCONUTS.

The year has not been a satisfactory one. The highest price obtained by auction for nuts was Rs. 55 per 1,000 in the month of January. The price gradually fell to Rs. 31 per 1,000 at the end of the year.

The young palm plantation has been thoroughly weeded and disc-harrowed, and all drains cleared and cleaned, the cheddy being mulched round all young supplies after being forked round.

The 10-acre plot of palms was limed in January and manured in March as per scheme laid down.

The large Java nuts have been put out in nurseries and are now ready to be planted out.

Attacks of Red Weevil (*Rynchophora ferruginea*) and Black Rhinoceros Beetle (*Oryctes rhinoceros*) appear to have been successfully checked, only five trees being under treatment during this period.

COFFEE.

There has been a considerable demand for Robusta and hybrid coffee seed. 251 lb. of seeds have already been sold, and orders continue to come in.

The dadap shade over all plots has been lopped to shape it on the same principle as that of the tea. All vacancies of the various varieties have been supplied.

The small plot of hybrid coffee raised from seed obtained in 1905 from Messrs. Leobenf, Paris, was cut down to 3 feet in December, 1915. The bushes blossomed in March, and were again in bearing in June. These plants were supposed to be immune to disease, but before cutting down both Hemeleia and green scale were found to be present on them.

The green scale (*Lecanium viride*) and leaf fungus (*Hemeleia vastatrix*) are common on most of the young coffee, but are kept in check by spraying with kerosene emulsion for scale, and Bordeaux mixture and resin-soda mixture combined for the leaf fungus.

PADDY.

The work on paddy consisted of the trial of new varieties, transplanting, reduction of the seed rate (single planting), and the introduction of green manuring crops. It has been conclusively proved that ¼ bushel of paddy sown thinly in a seed bed is sufficient to provide seedlings for planting out an acre, and that an acre so planted will yield more than one planted in the wasteful method commonly employed of sowing anything up to 2 bushels of seed per acre.

The portion below the road which had various green manure crops sown has been divided up and planted out with six-week old seedlings of the following varieties :—(*a*) Dr. Lock's selected paddy Nos. 1 and 2 ; (*b*) Molagusamba ; (*c*) Mulan ay Manilla ; (*d*) Senora Manilla ; (*e*) Macan Pina Manilla ; (*f*) Fino rice ; (*g*) Ein-el-Bint ; and (*h*) Phillippine.

VANILLA.

The vines flowered very freely in April, and harvesting of pods commenced by the middle of December. The vines are bearing a heavy crop for the first time.

ATTAPS.

Fresh-water Attap seeds from Java have been planted round the reservoir and in wet drains. Although living, the young sprouts do not appear to be doing well.

GREEN MANURES.

All the plots have been re-sown with various green manures, including the following new varieties from Jaffna:—*Tephrosia Vogelii*, *T. villosa*, *Cassia Tora*, *Crotalaria alata*, *Indigofera longeracemosa*, and *I. Anil*.

PLUMERIA PERFUME.

Experiments were conducted to extract the perfume by absorption into pure vaseline, the flowers (*Plumeria alba*) being laid in trays Samples of pomade were sent to the Imperial Institute, London, but the report received was unsatisfactory.

OTHER ECONOMICS.

Sugar cane, Manila hemp, Sisal, and the oil products are growing well.

Different varieties of sweet potatoes, yams, manioca, and sugar canes brought by the Director of Agriculture from Mauritius have been planted out in nursery beds, and are doing well.

LABOUR.

A great deal of labour has unavoidably had to be discharged, but it has been possible to retain a force sufficient to maintain the Station in good order. The general health of the coolies has been satisfactory.

H. A. DEUTROM,
Acting Manager.

January 31, 1917.

DRY ZONE EXPERIMENT STATION, ANURADHAPURA.

TOBACCO.

The following varieties were experimented with :—White Burley, Dumbara, and Zimmar's Spanish. The growth was as good as of those at Jaffna. White Burley was harvested in April, and gave 540 lb. per acre. Dumbara and Zimmar's Spanish, which were harvested a fortnight later, yielded 855 and 330 lb., respectively.

A leaf disease, quite common in America, due to soil conditions, but unknown in the Jaffna trial grounds, appeared in the plots here.

All the tobacco has been air cured, baled, and sent to Mr. Scherffius at Jaffna for final treatment.

COTTON.

Cambodia, Sea Island, and Upland cotton were given a trial. The yields were satisfactory, though a certain number of bolls fell in consequence of the unusually heavy rain in March.

COCONUTS.

Three acres of coconuts have been planted out 27 feet by 27 feet diagonally early in December, on unirrigable land, and are doing well. The seed nuts were obtained from Mr. F. Beven of Franklands, Veyangoda, and were specially selected from good bearing palms.

DURA.

The pink and red varieties made a very satisfactory show this year, and the yields were encouraging. The seed ripened in the dry weather. The crop was attacked by parrots and monkeys, attracted by its sweet and nutritious grain. Seeds of the best heads were carefully collected for distribution and for re-sowing.

The Red Dura grown from selected seed has been harvested in three months from sowing. This yielded 1¼ bushels first quality selected seed, and 1⅜ bushels second quality, totalling 2⅝ bushels, from one-tenth of an acre, or 21¾ bushels, equal to 1,348 lb. per acre. The heads were remarkably fine, and the grain large and easily threshed. Encouraging results have been received from the Assistant Government Agent, Mullaittivu, which indicates that the people are beginning to appreciate this grain as a food.

OILS.

The giant Russian sunflower has done much better here than at Peradeniya. The biggest head measured 1 foot 3 inches in diameter, and an average of 1 foot 2 inches in diameter.

Linseed made a fair show in the monsoon.

The oil palms continue to show rapid growth, and are kept continually irrigated.

FODDERS.

Teff grass, sown on February 10, 1916, was first cut five weeks later, and yielded two more cuttings, *i.e.*, three cuttings in all, in ten weeks when it was ploughed and re-sown.

Teosinte grew vigorously, and was much appreciated by cattle.

SUGAR CANE.

This was first cut in September, 1915, and the ratoons were cut in July, 1916. Canes have been sent for analysis as to sugar content.

OTHER CROPS.

Small areas have been planted with tea, cacao, coffee, date palms, guavas, plantains, pineapples, mangoes, citrus fruits, papaws, mangosteens, and soursops.

ANNUAL CROPS.

Trial plots have been planted with green gram, black gram, horse gram, cluster beans, kurakkan, millet, maize, cow peas, pigeon peas, sorghum, polong me, *Panicum miliare*, haricot beans, and *Dolichos lab lab*.

H. A. DEUTROM,
Acting Manager.

January 31 1917.

EXPERIMENT STATION, MAHA ILUPPALAMA.

COCONUTS.

The plantations have made good progress during the period under review. Plots A and B referred to in this report consist of the following :—

Plot A : 17 acres of 8-year old trees (ploughed and disc harrowed and growing on irrigable land).

Plos B : 6½ acres of 9-year old trees (not ploughed or disc harrowed, and growing on unirrigable land).

FRUITS.

The citrus trees are bearing good crops of fruits.

BOUNDARIES.

Owing to the bad condition of the boundary fence, herds of elephants, semi-wild buffaloes, and wild boar have destroyed a number of young palms. The fence is being repaired in the worst places. It will require a large sum than can at present be spared to put the whole fence into order.

H. A. DEUTROM,
Acting Manager.

January 31, 1917.

OTHER STATIONS.

CHILAW.

The coconut experiments have been continued on 16 plots situated at Millicent estate, Chilaw. The yields have been considerably in excess of those of 1915, and crop returns are being carefully recorded. Coconut experiments are also being carried out on young palms for the Department by Mudaliyar A. E. Rajapakse upon his property at Negombo. The growth of these young palms is being carefully recorded, and all details of the experiments are being most thoroughly kept by Mudaliyar Rajapakse, to whom the Department is indebted for his valuable assistance and advice.

Other coconut experiments are in hand at Pitiakande estate, the superintendent of which has kindly undertaken to attend to the recording of yields obtained.

VII.—SUMMARY REPORT OF THE TOBACCO PLANTER FOR 1916.

TRIALS AT JAFFNA.

The season was unusually hot and dry throughout, preceded by an abnormally light monsoon. During the transplanting period of January and February there was no rain, and but one cloudy day.

CULTIVATION.

The young plants were transplanted, hand watered, mulched, and shaded, and made a nice growth in their early stages. The ground became so hard and dry that no ploughing could be done until the land had been irrigated. The general method of cultivation and of manuring the crop were carried out as in the previous year, with a view to producing the brightest leaf possible. A smaller number of types were grown, selected from those that had proved most promising the previous year.

WATERING AND TRANSPLANTING.

Ten watering and shading tests were made on a uniform piece of ground, one cooly being detailed to transplant all. These tests ranged from three waterings daily (the plants being well shaded at transplanting) to no water for five days and no shade at all. At the end of five days every plant in all the tests were living, which indicates that upon careful transplanting depends the success of procuring a perfect stand. It is interesting also to note that the plot which was watered most made the slowest start to grow, and the best result was obtained by watering once in a hole by the side of the plant at transplanting, mulching, and repeating the operation every four days. In these tests there was but little moisture in the soil, and the experiment was started on January 28. I attribute the slow growth of the heavily watered plants to their taking up such large quantities of water that they procured very little plant food. It was not necessary for these plants to extend their roots in search of moisture of a more concentrated form as regards plant food. After a fortnight some of the plants were taken up, and it was found that the heavily watered plants had made the least amount of root growth.

IRRIGATION.

The well being located near the lower end of the field. it has been impracticable in the past for native growers to cultivate and irrigate the upper portion of the field, while the lower portion has been under intense cultivation year after year. We therefore seeded the lower end to Sunn hemp, for a manure crop, to improve its condition.

It was expedient, in order to obtain the best results, to carry on the main operations on the new land. This land was accordingly prepared and, in January, was transplanted, with the exception of one plot, which was intended for the manure experiments. It was proposed to water the upper end of the field by means of a pump which had previously been installed. Giant bamboos were sent from Peradeniya to be used as spouting, with instructions that they be kept in the shade until required for use. When watering, other than hand watering, became necessary, the bamboos unfortunately proved useless. Palmyra troughs had then to be prepared and put up for conducting the water to the side of the field, where we could build a bund as a last resort for getting water to the crop. As the grade was against us, this bund had to be constructed 5 feet high at the lower end. It was 850 feet in length, a limited amount of water was finally conducted to the crop through this channel, but not until the plants were stunted and a large number of them had died. The resulting crop was therefore not satisfactory.

HARVESTING.

The harvesting was done in April and May. All cigar wrapper leaf was harvested by the single leaf method, and all other types by the whole plant method.

CURING.

All cigar and pipe varieties were cured by the "air curing" method. Flue curing was again tried on a small quantity of the flue curing type. The tobacco was rather thick and fleshy, and only a mahogany yellow colour could be produced. It is now possible to state definitely that Jaffna soil is not suitable for the production of flue tobacco.

STRIPPING, GRADING, AND FERMENTING.

The stripping was begun immediately after the curing was completed, and the cigar wrapper leaf graded out for separate fermentation. The fermenting bulbs were made in the middle of June. The results of the fermentation are a great improvement over the preceding year, when the fermenting had to be done in an unsuitable room.

MANURE CROPS.

After the tobacco crop was finished, the Sunn hemp, which had been grown for manure was dug in on the old land. Cavali (*Tephrosia purpurea*), which had come up in several plots, was also collected and dug in as manure, leaving the land in a much improved condition for experimental work.

NURSERIES. 1916—17.

The nurseries for the 1916-17 crop were sowed September 26-29. Only a portion of the nurseries was shaded, but all did well. We found that there was less trouble from

insect pests if nurseries were sown early, because the plants had begun making a good growth before they were attacked. The transplanting of the present crop was begun on November 17. Our earliest plants are now coming in flower and look well.

FERTILIZERS.

No potassium being available on the local market this year, we secured from the Forest Department the brush from 2 acres of jungle which was collected and burnt, and the ashes were shipped to Jaffna to be used as a source of potash. For the present crop potash and superphosphate are being supplied at the time of transplanting, and nitrate of soda is being applied in solution, light application from time to time.

TRIALS AT ANURADHAPURA.

Four-fifths of an acre of land was planted with three types of tobacco, one pipe and two cigar types. They made good growth, and appeared to be of a very fair quality. The curing was unsatisfactory, as the weather was rainy and unfavourable during the curing period and the immediate supervision of the curing had to be entrusted to an inexperienced man. It was clearly demonstrated that good tobacco can be grown in that locality, but there is danger of its being spoiled in the curing process by excessive rain.

B. F. SCHERFFIUS,

January 24, 1917. Tobacco Planter.

VIII.—SUMMARY REPORT ON WORK OF CO-OPERATIVE CREDIT SOCIETIES.

SOCIETIES.

The following 14 new societies were registered during the year, bringing up the total to 68. Two more applications for registration have been received and were under consideration at the end of the year:—

(55) Godakahapalata.
(56) Siduwa.
(57) Haltota.
(58) Colombo Plumbago Employés.
(59) Dakunu Talangama.
(60) Mannar East Co-operative Fish
(61) Pandatarippu [Supply.
(62) Karaveddi.
(63) Puloli.
(64) Valikamam West Headmen's.
(65) Anaikoddai.
(66) Mahagama.
(67) Maha Palata North.
(68) American Mission Agents'.

MEMBERS

The total number of members of Co-operative Credit Societies is now 6,488, an increase of 2,230 over last year.

CAPITAL.

The paid-up capital of all the societies is Rs. 29,040.

LOANS.

Rs. 25,168 have been lent to members during the year, and Rs. 13,018·82 have been recovered.

WORKING OF SOCIETIES.

Western Province.—There are 19 registered societies in this Province. Five in Rayigam korale (inaugurated and worked by the Gate Mudaliyar Wirasingha, Justice of the Peace and Unofficial Police Magistrate) are making satisfactory progress. Three in Alutkuru korale north, under the presidentship of Mudaliyar Samarakoddy, are also making progress. Hewagam korale contains five societies. Two are working under the presidentship of Mudaliyar G. Dias Bandaranaike. One is not working. Kalapaluwawa has shown good work under Mr. C. A. Boteju, Advocate, its President. Talangama South Society is a new society, but is rapidly progressing. Two societies were started in Pasdun korale east by Mudaliyar Samarasingha. The society in Salpiti korale is not in working order, and the progress of the society in Siyane korale east is not satisfactory.

Southern Province.—The number of societies is nine. Four in Galle District: Talpe pattu, Gangaboda pattu, Hinidum pattu, Wellaboda pattu, and Akmimana and Four Gravets, which are all working societies under the presidentship of the respective Mudaliyars. Two in Matara District. Kandaboda pattu (President Mudaliyar Gooneratne) is showing steady progress from its inception. The Weligam Korale Society has been revived by the present Mudaliyar of the korale, its new President, Mudaliyar Illangakoon. Two in Hambantota District, Giruwa pattu west and Magam pattu, under the presidentship of the respective Mudaliyars. The former revived its work lately, and the latter is a successful working society.

Central Province.—The number of societies remains, as last year, 10, of which Walapane and Nagolla-Hulangamuwa are the only progressive societies. The Nagolla-Hulangamuwa Society has made notable progress after the new Secretary took up the duties. The Uda Dumbara Society held a meeting recently and revived its work.

Northern Province.—The number of societies has been increased to 17 from 10. The Udupiddi Society is doing good work from its inception, and the Jaffna Industrial Co-operative Society is showing some progress. Of the newly-formed societies, Karaveddi and Pandatarippu have started work with great earnestness. Tellipalai Society has been revived. Two of the Mannar societies (Nanadan East and Mantai South) have done good work

North-Western Province.—There are only 2 societies, the Hiriyala hatpattu, started and successfully worked by Ratemahatmaya Tennekoon, and the Puttalam Society, under the presidency of the Assistant Government Agent. The latter was reconstructed in April last with two sub-committees, of which Demala hatpattu has contributed to the progress.

Province of Uva.—There are 4 societies in this Province. Uva shows slow progress. The 3 societies in Wellassa under the presidency of Ratemahatmaya Bible have been of great help to the poor cultivators.

Province of Sabaragamuwa.—There are 3 societies in this Province, 2 in Kegalla and 1 in Ratnapura. The latter has not done any work. Of the former, the Galboda and Kinigoda korales, under the presidentship of Ratemahatmaya Boyagoda, has revived its work.

North-Central Province.—Out of the 2 societies in this Province, the Anuradhapura Society has begun work under the new office bearers. Mr. S. D. Krisna Ratne, Crown Proctor, has been appointed President.

Eastern Province.—Both the societies, which were registered in this Province, failed to justify their existence.

INSPECTION AND SUPERVISION.

The Secretary inspected 27 societies, and the Inspector 7 societies, during the year. The societies which were given regular inspection and closer supervision have made better progress.

GOVERNMENT LOANS.

The Walapane Society (in Central Province), the Kumbukke pattu and the Kalapaluwawa Societies (in the Western Province), the Hinidum Pattu Society (in the Southern Province) have received Government loans. The total amount of Government loans is Rs. 2,135, of which Rs. 161 has been repaid, leaving a balance on loan of Rs. 1,974.

CO-OPERATIVE SUPPLY OF MANURES.

Seven societies have purchased 79 tons of manure of a value of approximately Rs. 8,000 for paddy and coconut cultivations. These societies realize the benefits of such co-operative dealings, and continued to increase their purchases as funds became available

AGRICULTURAL DEVELOPMENTS.

All the societies, excepting 3 (which are industrial), are mainly bent on agricultural improvements. Several societies have tried new strains of paddy received through the Ceylon Agricultural Society, and a few societies with outside help are interesting themselves to start experimental gardens. Three societies have undertaken experiments with new manure mixture for paddy.

MISCELLANEOUS.

To meet the demand of the public for information on Co-operative Credit Societies, the Secretary wrote a leaflet on Co-operative Credit Societies, their advantages, and benefit. Another leaflet is being prepared.

N. WICKREMARATNE,
Secretary, Board of Control, Co-operative.
Peradeniya, January 31, 1917. Credit Societies.

IX.—REPORT ON WORK OF SCHOOL OF TROPICAL AGRICULTURE.

The school was formally opened by the Hon. Sir Anton Bertram, Attorney-General, on Saturday, January 15, 1916. In the daily programme the mornings are devoted to field work, and the afternoons to class-room work. During tillage, sowing, and reaping operations, however, the whole day is spent in field work; while at the termination of field operations near the conclusion of the session, the whole day is given to revision classes.

ADMINISTRATION.

The school staff consists of a Registrar and four agricultural teachers, who hold the diploma of the Poona Agricultural College. These teachers carry out the groundwork in all subjects. The field demonstrations in horticulture and planting were in the charge of the Curator, Royal Botanic Gardens, and the Manager, Experiment Station, Peradeniya, respectively. The members of the Scientific Division of the Department also gave special lectures. In estate accounts, the services of Mr. D. Clement de Silva, Chief Clerk of New Peradeniya estate, were secured. For practical work in chemistry, the use of the laboratory at Trinity College, Kandy, has been granted. A special course of work, theoretical and practical, in tobacco cultivation was conducted in Jaffna by Mr. B. F. Scherffius. We also had the advantage in the study of coconut cultivation of the co-operation of Mr. D. E. P. Rajapakse, of Alexandra estate, Jaela.

During the year, too, the four teachers used the periods free from actual school work for special work on particular cultivations: Mr. Cooke on tobacco in Jaffna; Mr. Hulugalle on coconuts in the Kurunegala District; Mr. van Buuren on tea and rubber at Peradeniya; and Mr. J. C. Drieberg on cacao in the Matale District.

STUDENTS.

The number of students admitted during the year was 77. Seventy-one of these were admitted to the English class, of whom 7 withdrew. Six Government vernacular trained teachers, who were sent here for two terms' work.

Each student had to cultivate 1/16 acre and grow three crops on it, a pulse, a grain and a vegetable, conducting all operations by himself. In the major operations of ploughing, discing, &c., groups of students engage; but under no conditions is outside assistance permitted, even in the management of the cattle employed. Similarly, roads are made, drains cut, trees felled, and land cleared.

With few exceptions, the English class was composed of the sons or relations of landowners, who came here to qualify for the management of their own property.

VERNACULAR COURSE.

The course for the vernacular teachers was given by interpretation through the Agricultural Instructor, Mr. L. de Z. Jayatileke, as the lecturers had not at that time qualified in the vernacular. The work of the teachers who came to this course was satisfactory, and a full report was furnished to the Director of Education.

EXAMINATIONS.

One full internal examination was held during the year. Test examinations in individual subjects were distributed at intervals. For the final examination in December, 1916, 56 students presented themselves; 41 passed.

AWARDS.

The interest of the permanent planting community has been secured, and this is exhibited in the prizes offered by its leaders for competition in the 1916 course. These prizes consist of five gold medals and four silver medals for the English class, and one gold and one silver medal for the vernacular class of six. Details of these prizes are published in the prospectus of the school issued in 1916. A few prizes have been offered by members of the school staff and the Department.

HOSTELS, &c.

Two hostels have been equipped for the residence of students under adequate supervision In them 32 students were accommodated. As this was insufficient, houses in the neighbourhood were recognized for residence of students; and these houses were regularly inspected. The health of the students was good on the whole, in spite of a few cases of chronic malaria and an outbreak of chickenpox in March.

MISCELLANEOUS.

The school has issued the first number of a magazine called "The Peradeniyan." It is hoped to make this the medium of all communications from students past and present. The objects of this magazine were carefully defined by the Principal in the issue referred to. The school has, further, a debating society, for the discussion of agricultural subjects, which has done good work under the direction of Mr. van Buuren.

I append a table of details and a financial statement showing the approximate cost of working the school:—

	Rs.	c.
Amount voted	15,890	66
Amount expended	14,810	57
Expenditure.		
Salaries	8,177	0
Lecturing fees	1,514	0
Incidental expenses	897	0
Catering for students	315	0*
Stationery and office requisites	970	0
Rent of quarters	1,050	0
Furniture	1,893	0
Receipts: fees and stationery	3,325	0
Attendance.		
Average number on register	71	
Average attendance	64	
Percentage of attendances	90	
Average age of students	21	

* Spent for board and lodging of six Government vernacular students.

ST. L. H. DE ZYLVA,
Registrar, School of Tropical Agriculture.

February 1, 1917.